

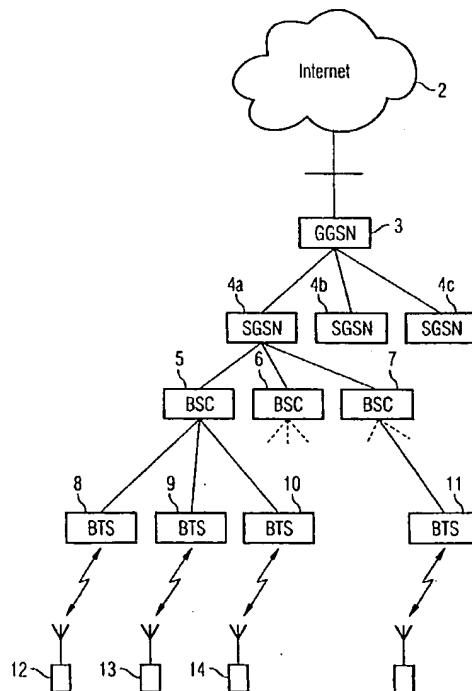
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(72) Inventor(s): Toby Proctor		(58) Field of Search: UK CL (Edition V) H4L INT CL ⁷ H04L, H04Q Other: Online: WPI, EPODOC, JAPIO
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(54) Abstract Title: Handover method for packet streaming data

(57) To facilitate cell change in a cellular communications network for a mobile engaged in a streaming data service duplicate packets are sent to a controller for the base-station to which the mobile is to re-attach. In a preferred embodiment the data includes a sequence number and when the mobile attaches it requests the next data in the sequence. The method is applicable to handover and also cell-reselection.



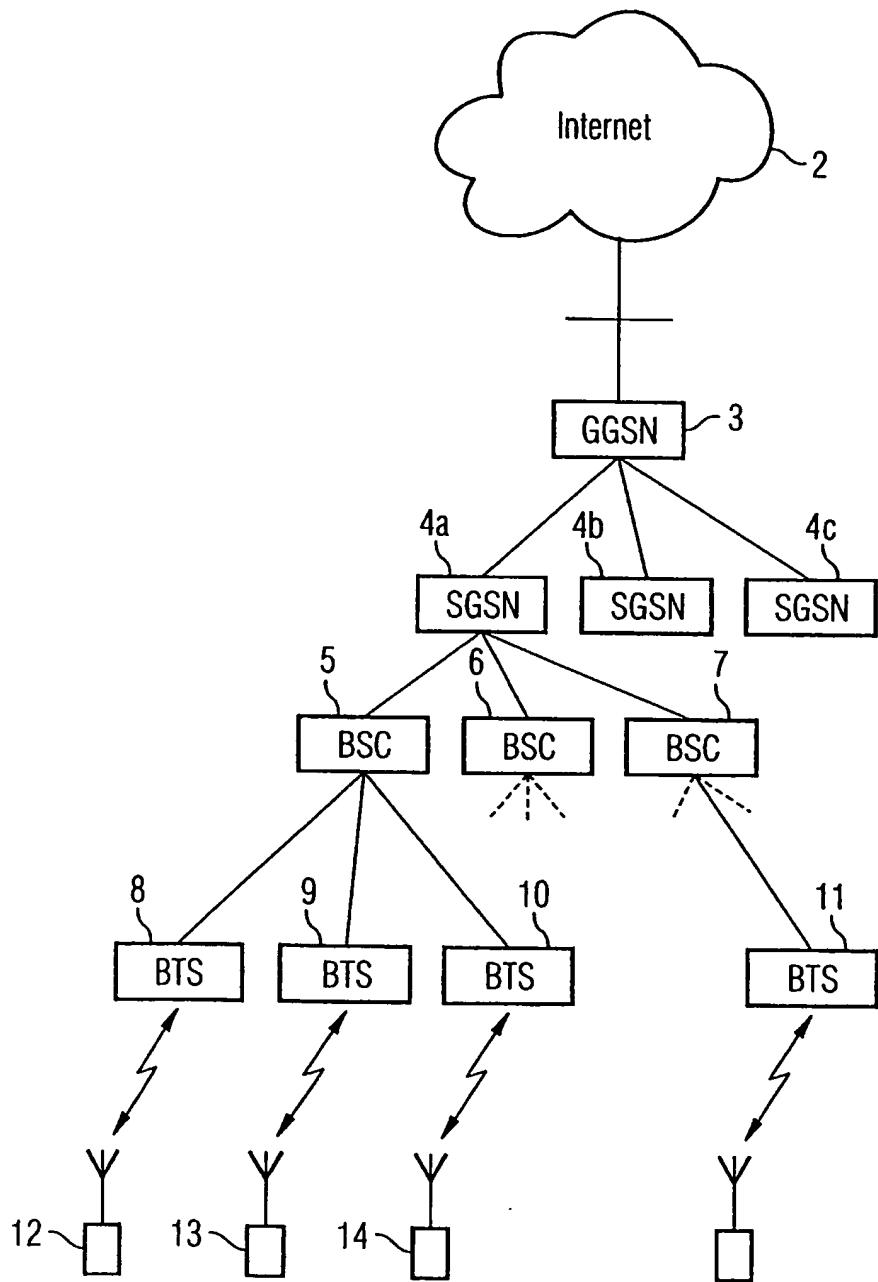
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A communication method and apparatus

5 This invention relates to a communication method and apparatus for a telecommunications network providing streaming services.

Streaming services involve the transmission of a stream of data to a mobile in a telecommunications network. They may be used for example to transmit moving images.

10 Telecommunication networks supporting mobiles have a large number of base-stations serving different geographic areas. The mobiles attach to the network via the base-stations but this is not a permanent state for it is possible for the mobiles to attach to the network via a different base-station in a cell change process. As the mobile moves location for example 15 it attaches to different base-stations using a well known process called hand-over. Another process of cell change is called cell re-selection. A problem will occur when the mobile is receiving a streaming service since there may be an interruption in the stream as the mobile undergoes cell change. Because the data is in a stream missing a packet or packets of data may cause the service to fail or degrade.

20 According to the invention there is provided a method of providing a streaming data service to a mobile in a cellular telecommunications network which method comprising; establishing a connection to the mobile via a first base-station of the network to communicate streaming data thereto, identifying at least a second base-station to be used in 25 the event of cell change, directing to the at least a second base-station a duplicate of at least part of the streaming data.

By directing a duplicate stream of data to the second base station, when the mobile leaves the first base-station and connects to the second base-station any missed data may be 30 retrieved from the second base-station.

Preferably, the data includes an identifier identifying its position in a sequence of data. This is preferred since it will enable the determination of the last data successfully received by the mobile and the transmitting of the next data in the sequence by the base-station.

A second aspect of the invention provides a method of providing a streaming data service to a mobile in a cellular telecommunications network which method comprising; establishing a connection to the mobile via a first base-station of the network to communicate streaming data thereto, changing the connection to the mobile via a second base-station, transmitting a message to a node serving the first base-station identifying the last data successfully received by the mobile and in response transmitting to the mobile via the second base-station the next data in the streaming data.

10 The invention also provides apparatus.

The nodes serving the first and second base-stations may be the same or different nodes.

15 A specific embodiment of the invention will now be described with reference to the drawings in which:

Figure 1 shows a communication network in accordance with the invention.

20

As is shown in figure 1, a cellular communication network 1 comprises a number of network nodes connected to the Internet 2. The network nodes include a first node 3 called Gateway GPRS Support Node (GGSN) connected to an external network 2. In turn the first node is connected to a set of second nodes 4. These are the Serving General packet radio service Support Nodes (SGSN).

25 Each SGSN 4 supports a number of Base Station Controller (BSC) nodes 5,6 and 7. These in turn control a number of Base Transmitting Sites (BTS) 8, 9, 10 and 11. The BTS serve a number of mobile units a few of which 12 to 14 are shown. Each BTS will serve a different cell and as the mobiles move the connections will be maintained using the process of handover which is well known by persons skilled in the art.

The communications network is thus to this point conventional in configuration and operation. However, in order to improve the performance in supported streaming data services it is operated in the following manner.

- 5 Let us suppose that mobile 13 is connected to a streaming data service on an external network 2. The connection is supported by BTS 9, BSC 5, SGN 4a, GGSN 3 and the external network 2. The data for the service is transported over the nodes as Protocol Data Units (PDUs) where no per PDU acknowledgement is requested. The PDUs include a sequence number indicating the position of that block of data in a sequence of the data stream.
- 10 When there is a requirement for the mobile to handover and to connect via a different BTS, the mobile send a notification over signalling channel that a handover is required and the preferred BTS. When there is a requirement for the mobile to re-select cells and to connect via a different BTS, the mobile halts all ongoing data transmission and moves to the new cell. In this example the mobile indicates that BTS 11 is the station from
- 15 which it receives signals with the best signal strength and that is the preferred station to establish connection with in a handover process.

Upon receiving this notification the BSC 5 notifies the SGSN 4a that a handover may be about to take place between the mobile 13 and BTS 11. The SGSN 4a acts on this

- 20 notification by duplicating incoming PDUs destined for mobile 13 and sending them to BSC 7 where the units are sent in anticipation of handover.

The BSC 5 then instructs the mobile 13 to initiate handover. The link between the mobile 13 and the BTS 11 is established. The mobile 13 then sends a message via the BTS 11 to

- 25 the BSC 7 indicating the last sequence number received in the streaming data service. The BSC 7 then sends the next PDU in the sequence.

The PDUs will include a discard by time such that any node holding a PDU that has not

- 30 been sent can discard it after a given period of time. Thus the PDUs remaining in the BSC 9 will be discarded after a predetermined time.

In an alternative embodiment of the invention the SGSN 4a, upon receiving a communication that the mobile 13 is connected to the network at BTS 11, sends a message

to the BSC 9 that it may discard any remaining PDUs that were destined for mobile 13. This confers the advantage that the buffer of the BSC is cleared more quickly than would otherwise be the case.

- 5 A further aspect of the invention will be described with reference to figure 1. This aspect concerns the case where cell change is a process of cell reselection. This process will be familiar to persons skilled in the art and it results in a mobile attaching to the network at a different base-station. Using the network shown in the figure, let us suppose that mobile 12 connects to the network via BTS 8 and it receives a streaming data service. Whilst engaged
- 10 in this service the mobile 12 continues to monitor the signal strength from the other base-stations. If the mobile detects that another site provides a better signal to strength ratio then it switches to that site and disconnects from the current one with or without the intervention of the BSC to which it is currently connected. Let us say that BTS 9 offers a better service then mobile 12 establishes the connection with BTS 9 and disconnects from BTS 8. In
- 15 doing this mobile 12 sends a message including the sequence number of the last data unit received from BTS 8 via the BTS 9 to the BSC 5 and thence to the SGSN 4a. The SGSN 4a then sends the next data unit in the sequence to the mobile via BSC 5 and BTS 9.

Claims

1. A method of providing a streaming data service to a mobile in a cellular telecommunications network which method comprising; establishing a connection to the mobile via a first base-station of the network to communicate streaming data thereto, identifying at least a second base-station to be used in the event of cell change, directing to the at least a second base-station a duplicate of at least part of the streaming data.
5
2. A method as claimed in claim 1 wherein the data has an associated indicator indicating its place in a sequence of data.
10
3. A method as claimed in claim 2 wherein the mobile transmits to the base-station the indicator associated with the last successfully received data.
4. A method as claimed in claim 3 wherein the base-station is responsive to the transmission of the indicator associated with the last successfully received data to transmit the next data in the stream.
15
5. A method as claimed in any one of claims 2 to 4 wherein the data is formed into protocol data units.
- 20 6. A method as claimed in any one of claims 2 to 4 wherein the associated indicator is a sequence number.
7. A method as claimed in any preceding claim wherein data held by the first base-station after handover is discarded in response to an instruction after handover of the mobile to the second base station.
25
8. A method substantially as hereinbefore described with reference to and as illustrated by the figure.
- 30 9. A method of providing a streaming data service to a mobile in a cellular telecommunications network which method comprising; establishing a connection to the mobile via a first base-station of the network to communicate streaming data thereto, changing the connection to the mobile via a second base-station, transmitting a message to a node serving the first base-station identifying the last data successfully received by

the mobile and in response transmitting to the mobile via the second base-station the next data in the streaming data.

10. A method as claimed in claim 9 wherein the message includes a sequence number
5 identifying the last data successfully received by the mobile.
11. A communications network in use operating in accordance with a method as claimed in any one of claims 1 to 10.
- 10 12. A network node for use in a communications network as claimed in claim 11.
13. A mobile for use in a communications network as claimed in claim 11.



Application No: GB 0300080.9
Claims searched: 1-8

Examiner: Steve Evans
Date of search: 15 September 2003

Patents Act 1977 : Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X	1, at least	EP 1128704 A1 (LUCENT) - Whole document
X	1, at least	US 20010046218 A1 (COSTA) - Whole document

Categories:

X Document indicating lack of novelty or inventive step	A Document indicating technological background and/or state of the art
Y Document indicating lack of inventive step if combined with one or more other documents of same category	P Document published on or after the declared priority date but before the filing date of this invention
& Member of the same patent family	E Patent document published on or after, but with priority date earlier than, the filing date of this application

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC^Y:

H4L

Worldwide search of patent documents classified in the following areas of the IPC⁷:

H04L; H04Q

The following online and other databases have been used in the preparation of this search report.

EPODOC, JAPIO, WPI